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THE GEYSERS OF CALIFORNIA.

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The Geysers of California are situated in lateral ravines of Pluton River, a tributary of Russian River.

The picturesque journey from San Francisco to the Geysers has been truthfully described by many tourists; hence most of our readers are doubtless familiar with the sail over the bay and through the Tulé marsh, the ride up the White-wine valley, the slow ascent of an outlying crest of the Coast Range, and the perilous drive down into the cañon. It is proposed to embody in this paper some observations based upon studies at the Geysers during the last week in May, 1866.

It is, therefore, necessary to pass over, without remark, the interesting journey thither, and occupy ourselves with a description of the Avernus rather than the *facilis descensus*. The Avernus of the Æneid seems to have been a watering-place of some repute, which was in such immediate proximity to the lower regions, and presented such great attractions on account of being upon the most desirable route thither, that the name came, at

last, to be applied as much to the sulphurous depths below as to the oak-shaded lake above. Various points of interest in this occidental Avernus have received appellations suggested by the surroundings; and while some other localities on the Pacific coast have been named for public officials, it has not been considered complimentary to attach modern proper names to anything in the vicinity of the Geysers. For this reason the classics have been laid under contribution. The stream into which the main cañon opens is called Pluton River, the gorge is known as the Devil's Cañon, and a sulphurous grotto has been long named for Proserpine.

In gaining a clear idea of the California Geysers, it will be necessary to forget the geysers of Iceland, with their columns of water and capitals of cloud. Upon approaching those upon Pluton River, your first impression is that there has been a great conflagration, and that the fire engines are blowing off steam preparatory to going home. The gorge is lined with masses of smouldering ashes, from which hot steam is being drifted by the wind, and, in some places, you can imagine that the embers are ready to relight. In the bottom of the cañon, turbid and blackened water, from which vapor slowly lifts, is running among the discolored rocks. Here and there, escaping steam hisses, and, in some places, roars like the "exhaust" of an engine.

In other smaller cañons and depressions on an irregular table land, there are like appearances of chemical activity. The rocks in the vicinity are mainly sandstones and silicious slates, which are highly metamorphic. The intermediate varieties are innumerable, all belonging to the Cretaceous Series,* which is largely represented in

* Geology of California, vol. 1, p. 94 et seq.

the northern Coast Range of the State. Two belts of eruptive rock have been observed in this part of the State, one lying thirty miles south, and the other found between the Geysers and Borax Lake, twenty or more miles away. Both are on the line of former volcanic activity, and near both we find many thermal springs.

Besides hot springs, incrustations of sublimed sulphur, pumice, and the light lavas are regarded as traces of volcanic action. These are found in many places in California, and in Nevada. The writer has observed these indications near the summit of the extinct volcano, Shasta. In all cases they point to former igneous activity. Therefore, the steam-springs and the Solfataras may be considered, for all practical purposes, as the poor relations of volcanoes in reduced circumstances. Such are the Geysers.

Upon the 28th of May there had been a slight fall of rain. The morning of the 30th was quite cloudy, the thermometer ranging at eight o'clock from 60° to 62° Fahr. The temperature of the water in Pluton River, immediately above the confluence of the stream from the Devil's Cañon varied from 65° to 70°. At the mouth of the cañon the temperature of the water was 90°, and upon walking up the bank of the stream the different temperatures of 95°, 97°, and 100°, were noticed. A light vapor was rising from the surface of the water.

The first spring where ebullition was observed had a temperature of 135°. There was a free escape of sulphydric acid from the cloudy water, and here the hot, stifling moisture began to make the walk one of discomfort. Upon the right hand several small springs of 190°, all giving off sulphydric acid, were boiling violently, and at the edge of a queer miniature cave on the same side,

there was a furious little cauldron seething at 200°. Several of the springs had low forms of cryptogamic vegetation growing upon the walls of the basins, and, in some instances, confervæ were observed thriving in water of a temperature of 145° Fahr. Seventy or eighty rods from the mouth of the cañon, there is a jet of escaping steam, and a little farther on there is an escape-pipe, nearly ten inches in diameter, through which steam is forced out several feet. Part of the steam condenses at five feet from the orifice, the rest ascends as light vapor, and is borne away by the wind. The greatest degree of temperature observed was 206° Fahr., where there was, of course, as in the other cases mentioned, apparent ebullition from escape of gases. In no instance was the temperature of 500° noticed, which Mr. Bowles* speaks of in his entertaining "Across the Continent." Obviously, this is a slip of a flying quill.

Upon the east and west sides of the cañon, at this point, the ground is made up of decomposing rocks of clayey consistence, and of various colors dependent upon metallic oxides; each little locality seeming to be a laboratory for the decomposition of silicates. Wherever the light soil was dry, there was no vegetation whatever; wherever there was a good degree of humidity, confervoid growths were scattered. Near springs, a few rods farther east, a species of grass, Panicum, was seen growing; and, in one instance, at the water's edge where the panicle was bathed in slowly-rising vapor. This species is abundant near fumaroles, which are little natural blast chimneys, lined with crystalline needles of sublimed sulphur.

*"Across the Continent," p. 282. "They are of all degrees of temperature, from one hundred and fifty to five hundred.

This leads next to the subject of incrustations, which for our purpose we may divide into three groups, namely: silicic acid, sulphates, and sulphur. The first comprises the crystals of quartz, which are found upon slates embedded in the soil. They are minute, but very perfect.

The sulphates, such as crystals of ferric and magnesic sulphate, and the alums were not seen in their best estate. The rain of May 28th had dissolved the largest ones, and while we regretted this loss, we consoled ourselves with the thought that the rain, which had robbed us of our jewels, had added intensity to the chemical action going on around and below. It is stated upon good authority that the action is more intense during, or at the close of the rainy season, which is the winter of California.

The sublimed sulphur presents the two prevailing forms; namely, that which has crystallized with free access of air, and resembles the obtuse oblique rhombic prisms of sulphur familiar to chemists; and that which is produced under pressure, and has a slight inclination of the vertical axis.

In some limited localities there are effloresced salts, and pale, faded carbonates. At one spot, a light green cupric carbonate was partially covered with a darker green confervoid growth, and each shaded into the other like colors on a palette.

But the salts just referred to are those which have been left by the heavily charged water. Imagine, therefore, the variety of dissolved salts which must have been formed, by the over-heated steam and sulphur acids, from the rocks which are being so rapidly leached under pressure. The solutions are, almost in every case, acidulated by a high sulphur acid; free sulphur floats in the water, and

sulphydric acid escapes with violent ebullition. It must be supposed that in these acidulated solutions, the iron exists as a ferrous salt, since sulphydric acid has this reducing power.

In one spring, which is very nearly neutral, the iron has been incompletely precipitated and is suspended, in the agitated water, with other insoluble sulphides.

Another spring is strongly acidulated, and contains only the merest trace of the sulphydric acid, which everywhere fills the atmosphere. The rationale of the reactions observed at the Geysers is not obscure, but so far as the writer is aware, no careful analyses of the waters and sinter have been made upon the spot. The scrupulous care with which the geological survey of California is being conducted, warrants the conclusion that trustworthy examinations will be published in due time.

The writer is unwilling to conclude this imperfect sketch of one of the wonders of California, without bearing his personal testimony to the value of the labors of Professors Whitney and Brewer, and the hard-working corps.

The first volume upon geology has been read and questioned in the presence of the Coast Range and Sierra, from Point Concepcion to the Oregon line, and it has, at all times, proved a reliable guide.

NOTE.—See, also, a very interesting article by Professor F. Shepherd, in "Silliman's Journal" for September, 1851, when the springs were far less easily accessible than now.

THE ENCAMPMENT OF THE HERONS.

BY W. E. ENDICOTT.

An account of an encampment of the Herons may not be uninteresting to such as have never seen one. The herony in question was in Norfolk county, Mass., until the present year; the birds have now, however, taken up their abode elsewhere, because of the almost ceaseless persecution they have suffered. The species was the Night-heron or Quawk (*Nyctiardea Gardeni*). The bird is by no means as graceful as the other herons in figure, being thicker, with a larger and clumsier neck; as to color, however, it is quite handsome, being white, slate, and lilac. It has the long nape feathers characteristic of the herons, rolled, as usual, into the likeness of a tube. The place in which they have hitherto bred is a swamp, wet, and difficult of access, with no turf to set foot on, owing to the shade of the swamp-cedars with which the quagmire is covered, whose slippery, mossy roots furnish a doubtful footing in some cases, and a formidable obstacle in others. The certainty of "slumping" through the moss, thereby going into the thick slime above the knees, the probability of missing one's footing, and going down, full length, on breast or back, and the prospect of hard and disagreeable work in climbing to the nests, are among the allurements to the herons' paradise. The birds undoubtedly built there in 1861, though they were not found until June, 1862, when a gunner, breaking in upon their fancied security, shot over twenty for sport, threw them into a pile, and left them.

All, of course, who cared for natural history, who were few; the idlers, who were more; and many who had

never killed anything larger than a robin, and now were all agog to cover themselves with glory by shooting a quawk, frequented the spot nearly every day during that summer. The first thing which called the attention of the explorer was the whiteness of the ground, owing to the excrements of the birds; the air, hot and close, was loaded with its keen, penetrating odor; the fine particles of it, floating in the air and coming in contact with the perspiring body, made one smart all over. There was also a smell of the decaying fish which lay around, some dropped by accident by the old birds (who, I believe, never stoop to pick them up again), and much more disgorged by the young when their tree was assailed. These fish were mostly such as could not be obtained in the ponds and rivers. I once saw a piece of a pout, and once a fragment of a pickerel, but most of the remains were those of herrings. On the branches of some of the trees I have seen eels hanging with their heads digested off. The rough nests were always built against the trunks of the trees, six or eight feet from the top; and sometimes two, three, or even four might be seen in one cedar. The light-green eggs were usually four in number, but I have seen five and six repeatedly, and, once, seven in a nest. The young are downy, soft, helpless things at first, but soon gain strength enough to climb to the upper branches where they hang on with bill and claws, and are fed by their parents till nearly full-grown. Two broods are often reared in a single year, and it is no uncommon thing to see four or five of the first brood sitting on the tree-top, while the nest below contains as many more of their younger brothers and sisters; both lots, of course, to be fed by their parents. They climb clumsily, and seem, at every step, to be in immediate danger of falling,

yet it is very difficult to dislodge them. When they strike the ground they set off at full speed, and might easily escape did they not croak unceasingly as they run. The first year many of the young were carried away as pets. I kept one several weeks. No confinement was needed, for he had no more idea of running away than my hens had. Early in the morning, and for an hour or two after sunset, he would walk away into the lowlands, but would come back to his perch regularly. He was unable to forage to his complete satisfaction, however, and would sometimes try to catch my young chickens. I then took to fishing for him, and then, to my sorrow, I found out what a heron's appetite is; and thought, with pity, of the poor parent-birds in the swamp with six or eight such maws to fill. Five bream, as large as my hand, were not too much of a meal for him. He would catch them, all alive, out of the tub of water by the middle of the back, toss them up until he got them into the right position, head first down his throat; then he would swallow them by dint of great exertion, his neck presenting a curious appearance, as the fish, four inches broad, passed slowly down, making occasional convulsive attempts to struggle; a proceeding which seemed to enhance the pleasure of the bird. I once gave him a dry dead fish which he got half-way down, where it stuck; he tried and tried in vain to swallow it; then he made equally futile efforts to disgorge; then he turned his eye on me reproachfully and imploringly, so I was fain to take him between my knees, and tip up his bill and pour water down over the fish with a spoon, until the dried-up slime became again moistened, when, with a long pull and a strong pull, the bird engulphed him, gave me an ungrateful peck, and stalked off with a "q-u-a-w-k."

ARTIFICIAL OYSTER CULTIVATION IN FRANCE.

BY F. W. FELLOWES.

In a previous article having briefly described the generation of the oyster, the writer will, in the present one, give an account of the cultivation of this favorite mollusk as practised in France, and notably at the imperial, or model *parcs* in the *bassin d'Arcachon*.

This bay was apparently intended by Nature for an oyster farm, and its rich, firm, muddy bottom has *always* yielded them in vast quantities until about 1840, when, to the regret and astonishment of the fishermen (who had mercilessly dredged them up at all seasons, and had killed the goose that laid the golden eggs), their mine was found to be exhausted; fine, full-flavored oysters that had been heretofore bought for three or four sous the hundred, now readily sold for three francs and upwards, and even with these prices the oystermen were starving.

In 1859, Professor Coste, by order of the emperor, passed the summer at Arcachon, and studied the then unknown subject of oyster cultivation, located the now flourishing and successful *parcs*, and addressed a report to the emperor urging the immediate replanting of these exhausted beds. The following year his suggestions and plans were carried out under the immediate supervision of this naturalist, with surprising and satisfactory results. Here are nearly two thousand acres of excellent bottom for growing oysters, *uncovered* by the tide for an average of two hours at each low-water, and with the mild winter climate of the southerly coast of France, this circumstance is of priceless value, as it enables the laborers to

work among, and even handle the oysters at will, and renders the term "oyster farm" specially applicable to this locality.

A *parc* is regularly laid out like a market garden, into squares of say two hundred feet, a path goes all around and through them, a post is fixed on the corner with the number of the lot painted on it, and a record is kept by the superintendent of what size, quantity, and quality of oysters are planted on each, and his books and stock are inspected at stated intervals. Common curved tiles of baked clay, costing less than a sou a piece, have—after experiments with various contrivances—proved to be the most practical method of catching the drifting "spat." These tiles, or *tuiles* as they are called, were used at first just as they came from the kiln; but it was found that so large a proportion of the "spat" followed with its young shell the inequalities of the surface, grew so firmly to it, and were destroyed in separating them from the tile, that another ingenious plan was adopted. The tiles are dipped into a kind of cement containing sand and hydraulic lime, which, drying in a few minutes, coats them with an evenly rough surface in every way attractive to the "spat." When it is desirable to remove the oysters, a chisel, fashioned to follow the curve of the tile, is easily introduced between it and the oyster, which drops off uninjured.

About the middle of May these tiles are arranged in piles, ten feet long, five feet high, and five feet wide, which structures are called *ruches* or *les ruches tuilées*. These tiles are piled in various ways; usually they are placed with the concave roof uppermost, each layer running transversely across the layers beneath it. The sides of the tiles do not touch, but are separated by about

three inches of space, and often, though not always, adult oysters are laid along in these spaces. When the *ruche* is otherwise completed, heavy stones are placed upon the top to make the mass more solid and safe to resist the action of the stormy waves. Oysters are strewn all around these *ruches*, which are regularly separated from each other by a space of fifteen feet. Between the *ruches* bundles of faggots, or *fascines*, bound together in the middle with galvanized wire, are suspended about one foot from the bottom, by a cross piece made fast on two low posts. When the drifting "spat" is ready to adhere to a suitable object, a very large proportion of it is caught by, or seeks refuge in one or the other of these friendly asylums, and safely grows to the usual merchantable size.

One of Professor Coste's early experiments was with a box a yard square, perforated with holes, containing two shelves with bottoms of coarse wire-cloth. Sixty adult oysters were placed on these shelves and on the mud on the bottom. The sides and top of this box—made in pieces to take apart—were roughed up with an adze to attract and secure the "spat," but this plan was abandoned for two reasons; first, the unavoidable expense, and, secondly, it was found that the "spat," when first evolved, is not ready to adhere to anything, however suitable, but must swim about for a few days; and so the enormous quantity of little ones, given out by the mother oysters in the box, escaped through the holes and located themselves elsewhere. The tiles and the faggots are now in universal use. By the middle of August the oysters have finished their reproductive labors, and begin to fatten again, having become very poor during the summer, but the tiles and faggots are not taken up until a month later.

By that time, all the "spat" has located itself, and the *ruches* are carefully taken apart, each tile being laid down in the same position as in the *ruche*, side by side in long furrows or ditches prepared for them.

There they are allowed to remain until the following summer, when the oysters on the upper side of the tiles are removed and planted in beds, hollowed out about three inches deep, running the length of the *parc;* while the tile is then turned over with the roof-side downwards, and the oysters on the other side are left to grow as they at first fixed themselves, unless, being too much crowded, they grow upon each other, and in irregular shapes; in this case they are thinned out. The writer saw many thousands of tiles in rows, with oysters three years old, and of handsome size, still growing where they first were "set;" but usually they are all removed to the beds the second year, and the tiles, after being redipped in the cement, are again piled as before.

The faggots are taken to some enclosures, which are called *claires*, which are made of solid mason-work, water-tight, where the water can be admitted and excluded at pleasure, and where the waves can have no power, and are there unbound and left to themselves to grow until large enough to be separated from the branches, which is usually six to eight months, when they are treated like those grown upon tiles.

At the end of the third year, the oysters have attained the most desirable size, and are ready for the market. Those grown in the imperial *parcs* are not sold, but are consumed by the emperor, presented by him to crowned heads and friends, either for use or to stock their private *parcs*, or abandoned to the poor fishermen, who on a certain day are allowed to gather them.

The princess Batichiochi, a near relation of the emperor, has a large farm in the bay of Quiberon, and sells oysters to supply the Paris restaurants and others, in large quantities; and, though her farm was only in its third year, it was, as the superintendent remarked with pride and pleasure, more than paying expenses; but *next year! "mais l'année prochaine nous ferons des belles affaires, allez!"*

The sale of the yearling seed is made a special business by some oystermen, and they bring from four to six francs the thousand. They are put up in round baskets with a small hole in the top, and are kept, at the season of sale, suspended from scaffoldings erected over the water for the purpose, so that the baskets are never above the surface.

The French oyster-growers are very particular that the oysters taken up for market shall lie for five or six days in the *claires*, before forwarding them to the consumers; this is done in order that all mud and impurities shall be washed out in the pure sea-water, and the oyster is certainly whiter and handsomer for this clean bath.

The *Marennes*, or green oyster, is colored by being placed in *claires* when the tidal water is let out at certain intervals; a confervoid growth is induced which gives the highly prized color and flavor, and doubles the value of the oyster.

The *Ostende* oysters are placed in wooden vats, and are frequently tossed and tumbled about by women with rakes, thus breaking off the thin edge of the new growth of shell, and forcing it to grow more round and deep. Labor, in this country, is much too high to make a remunerative cultivation of the oyster in this manner practicable.

Oyster-growers recognize their own *tuiles* by a sort of trade-mark, which, by French law, it is forgery to imitate. After the *tuile* is moulded, and while still soft, a hole is punched in the top, either round, square, triangular, or of any desired shape; this private mark is recorded in due form, and wherever a tile bearing it is found, it is the unquestioned property of the one who has, so to speak, put his sign manual upon it. Our own laws protecting the oyster-grower need considerable alteration and improvement, especially in the State of Connecticut, where the oyster interest is a very large one; but our legislators, when the subject is properly put before them, will no doubt see the justice of giving the same protection to the marine, as to the cereal farmer, when each invest their money, and conduct their business equally in accordance with the law.

THE QUADRUPEDS OF ARIZONA.

BY DR. ELLIOTT COUES, U. S. A.

(Continued from p. 292.)

FAMILY *Viverridæ*, the Civets, etc. The very curious animal which forms the sole North American representative of this family, containing numerous species in the old world, has been found in so many localities contiguous to Arizona, that beyond a doubt it should be included here, though I am not aware that it has actually been taken in the Territory. The Ring-tailed Civet Cat (*Bassaris astuta*) is a queer animal, combining in itself the features of several distinct groups. Thus it has the ringed tail of a raccoon, the pointed snout and cunning

look of a fox, and the habits, at least in semi-domestication, of a house cat. It is well known to the hunters and miners of California, and by them highly prized as a pet. It is indifferently called "Mountain Cat," "Cat Squirrel," and "Raccoon Fox"; is easily tamed, and makes an interesting pet, as well as a useful one, from its dexterity in catching rats and mice. In a state of nature, it is said to be chiefly nocturnal, and to show spirited fight when attacked. It is about as large as a house cat; above, is yellowish or brownish-gray; below, white; and its tail is annulated alternately with black and white.

Family *Mustelidæ*, the Martens, etc. I am not aware that either of our two North American species of the genus *Mustela* occur so far south as Arizona. Of the Weasels, composing the allied genus *Putorius*, the species most likely to occur are the Bridled (*P. frenatus*), or its Californian representative, *P. xanthogenys*. The common American Mink (*P. vison*), of so very general distribution, may also occur. Hunters have several times described to me an animal they called the "Carcajou,"—which is the Wolverine (*Gulo luscus*),—and their accounts seemed quite pertinent, though I do not venture, upon such doubtful authority, to assert that it is an inhabitant of Arizona. Its existence has not been demonstrated farther south than Salt Lake City. The whole sub-family *Martinæ*, composed of the three preceding genera, is by no means so well represented as the *Melinæ*, comprising the Badgers (*Taxidea*), and the Skunks (*Mephitis*).

The family is chiefly developed in Arizona in these last-named animals, which have attained so unenviable a notoriety from their peculiarly disagreeable odor, believed to be the most powerful and noisome animal stench known. With this drawback, they are certainly beautiful

animals, both in form and colors. The latter are always pure black and white, at least so far as North American species are concerned; and there is a great similarity between them all in this respect. Dr. C. B. R. Kennerly obtained a Skunk at Pueblo Creek, which he says was intermediate in size between *Mephitis mephitica*, and *M. bicolor*. It probably belonged to the former species. Others, well known to occur in Texas, New Mexico, etc., and therefore likely to occur in Arizona, are *M. bicolor*, the little Striped Skunk; *M. varians*, the Texas Skunk; and *M. mesoleuca*, the White-backed Skunk. The first named of these extends across the Territory into California, and quite to the Pacific coast, where I have myself known of its occurrence. It is the smallest of all our species, and the only one which is spotted or streaked. The last is a most beautiful species, well figured by Audubon and Bachman, though under the erroneous name of *M. macroura*. It belongs to a different sub-genus (*Thiosmus*) from the rest, being distinguished by having one less upper molar, and a peculiarity in the position of the nostrils.

Concerning the occurrence of the third sub-family, *Lutrinæ*, I am unable to speak positively. It is most probable, however, that Otters do exist in the Territory, and they may be referable to that species described by Dr. Gray as *Lutra Californica*, which Professor Baird has considered to differ in some appreciable points from the common *L. Canadensis* of the Eastern States.

Family *Ursidæ*, the Bears. The two North American genera of plantigrade carnivora are represented by the Raccoons and the Bears. The former, *Procyon*, differs from *Ursus*, which comprehends the true Bears in dentition, and in many external characters, among which

the most notable are its small size, and elongated tail. I met with no Raccoons in Arizona, and it is doubtful if any exist; though *Procyon Hernandezii*, or that variety of it which Professor Baird has called *P. Mexicana*, from Sonora, may possibly occur.

Bears of at least two species are found, and are not uncommon, at least in all the wooded, and particularly the mountainous portions of the Territory. The vicinity of the San Francisco and Bill Williams Mountains was formerly noted for the numbers of these animals found there, though they appear to have somewhat decreased of late. The southern Rocky Mountains, and the ranges of California, seem to be particularly the home of the huge Grizzly (*U. horribilis*), which becomes less numerous farther north. A variety, characterized as *U. horriæus*, extends into Mexico. The common Black Bear (*U. Americanus*) also includes Arizona in its very extensive range.

Order *Marsupiata*, the Marsupials. A single family and genus (*Didelphys*) represents this remarkable order in North America. The Opossum of the Pacific slope is the *D. Californica*, which differs from *D. Virginiana* in several respects. It is smaller, and darker colored, especially about the head and feet, which parts are almost dusky; besides which the ears are black, blotched with yellow; and the tail also is particolored.

Order *Rodentia*, the Gnawers. This extensive order embraces animals which, by their individual numbers, and their great diversity in form and habit, always constitute a marked feature in the fauna of any country which they inhabit. It is remarkably well developed in Arizona, which has more species of Rodents than of all other orders taken together. If the part these animals play be

less prominent and conspicuous than that of the large carnivores or ruminants, it is not on that account the less interesting. And even in an economic point of view, it is scarcely less important; for the commercial value of the fur of some species, and the destructive agency of others, in field or in warehouse, gives them a consequence to a degree surpassed by no other animals. Aside from these practical considerations, the naturalist finds in this extensive group large room for study and investigation; and the diversity in form and structure and variety in habit exhibited, cannot fail both to please and instruct. The transition from the graceful, vivacious, arboreal squirrels to the clumsy, inactive, terrestrial marmots is great; but no intermediate links in the chain are wanting, and each one is curiously wrought and chased, with a story of its own to tell. Space will allow me to notice in detail only some of the more prominent rodents; and of the others I must perforce "make mere mention."

Family *Sciuridæ*, the Squirrels, etc. The most characteristic, as well as most abundant species of Squirrel, is the Tuft-eared (*Sciurus Abertii*), discovered by Dr. Woodhouse in the San Francisco Mountains. It is one of the largest, and certainly the very handsomest of all our North American species. Besides very beautiful and harmonious colors, it rejoices in the possession of long pointed ear-tufts, extending an inch or more from the edge of the conch of the ear, which give it a peculiarly sprightly and truly elegant appearance. But it is not the case, as generally believed, that these ornaments are constantly present. I do not know what regulates their growth or fall; but certain it is, that under some circumstances, or at certain seasons, they are wanting, either wholly or in part. I have even shot specimens on the

same day, in some of which they were fully developed, and in others wanting. They may possibly be a sexual distinction. Their absence is the main diagnostic point of a *S. castanonotus*, described by Professor Baird,—a supposed species most probably identical with *S. Abertii*, as that eminent naturalist himself now believes.

The pine-clad mountains of northern and central Arizona are the chosen home of this Squirrel; and it rarely, if ever, quits these woods for other situations. It is there a resident species, breeding in abundance, and braving the rigors of winter. Its food is chiefly pine and other seeds, particularly pinoñes, the fruit of *Pinus edulis*, together with acorns of the several species of oaks which grow plentifully in the openings among the pine forests. Considering how seldom it is molested in those wild regions, it is a shy and wary species, and when it discovers an intruder, leaps with great celerity to the top of the pines, whose size and dense foliage in a great measure screen and protect it. It is also a very vigorous and muscular animal, requiring to be "hard hit" before it can be dislodged from its stronghold. Even when mortally wounded, it clings with surprising pertinacity, and for a long time, to its perch. Its cries are much like those of a Fox Squirrel. If wounded and captured, it shows determined fight, and can inflict a severe wound if incautiously handled.

Near the eastern limit of the Territory I one day observed a small squirrel, about the size of our chickaree, running among some rocks and bushes. Unluckily I failed to secure the specimen; but have little doubt that it was the rare and slightly known *S. Fremontii* Aud. and Bach. If this identification be correct, the locality is the southernmost as yet on record for the species.

It is just possible that a western Fox Squirrel (*S. Ludovicianus* Custis, or *S. limitis* Baird) should extend into eastern Arizona; or that *S. fossor* Peale, of California, should reach the Colorado River. These, however, are rather speculative than demonstrated assertions, and await proof.

In addition to the preceding, a true Gray Squirrel inhabits Arizona, which I am inclined to think is a species new to science. It must be quite rare, as I never saw or obtained but a single one,—a female, shot December 20, 1865, at Fort Whipple. In general appearance it is similar to the common Eastern species, with which it agrees closely in the colors of the body; but it is smaller, and at the same time the tail is both relatively and absolutely longer, as well as much broader. It is possible that this may be the species alluded to by Professor Baird, page 263 of his "Mammals of North America," as "Sciurus Carolinensis??", from Santa Catarina, N. M. But his description applies only approximately to my specimen, which I shall describe as new.*

*SCIURUS ARIZONENSIS Coues, sp. nov.—*Diag.* S. formâ et coloribus corporis Sciuro Carolinensi similis; sed minor, caudâ longiore, latiore, subtus distinctè tricoloratâ.

Description.—Rather smaller than the Eastern Gray Squirrel; of the same form and body-colors; the tail longer, fuller, and much broader. Ears moderate, untufted, both sides furred. Palms 5-tuberculated, nearly naked, but a little hairy on the concavities of the fingers; 4th finger longest, 3d nearly equal, 2d equal to 5th. Soles 6-tuberculated, naked to the heel, but furred rather far around on their sides; 4th toe longest, 2d and 3d nearly equal and but little shorter. Tail to end of vertebræ equalling length of body from nose to root of tail, the hairs projecting 3 1-2 inches beyond terminal vertebra. Above, from nose to root of tail, a uniform mixture of gray, black, white, and tawny; the latter predominating. On the sides of the body, and outsides of the limbs, the tawny and black disappear, leaving a clear grizzle of gray and white. Below, from chin to anus, with the insides of the limbs, pure white; very trenchantly defined against the color of the upper parts and sides. Both eyelids and cheeks about the nose white; woolly space at base of ears ochraceous white. The tail from above is basally of same color as outside of thighs, the tawny of the back stopping abruptly at its base; in the rest of its extent it is black, broadly fringed with white, and having white hairs scattered sparsely through its black portion. Viewed from below, the tail is tricolor, being centrally tawny, bordered with black, which is in turn fringed with white.

Dimensions.—Nose to anterior canthus of eye, 1.1 (inches and tenths); to root of tail 9.5. Tail to end of vertebræ 9.5; to end of hairs 13.0; its width at broadest part fully 6.0. Height of ear .8. Longest whisker 3.3. Palm to end of longest finger with claw 1.6; from olecranon to ditto 3.6. Heel to end of longest toe and claw 2.3; greatest width of sole .7.

Of the Striped Ground Squirrels, or "Chipmunks," composing the genus *Tamias*, only one species is common, which is the Gila Chipmunk (*T. dorsalis* Baird). It is a beautiful little animal, rather larger than the common Eastern one, and conspicuously different in the character of the dorsal stripes. It was first described from the deserts of Southern Arizona, but I found it abundant at Fort Whipple, and it may extend considerably farther north. Unlike most others, it is a rock-loving species, and rarely quits its favorite resorts. Among masses of lava and gneiss it may be seen tripping lightly and gracefully, its pretty tail held arched downward, or flirted from side to side. It is a shy and suspicious animal, though so rarely molested, and scarcely exhibits the familiarity of disposition shown by its Eastern congener. When alarmed, it hurries precipitately to the mouth of its retreat, where, as if conscious of security, it sits and chatters an angry defiance at the intruder. It is a permanent resident around Fort Whipple, but hardly seen during the winter, which it passes in its burrows, in which an abundant supply of food, in the shape of nuts, acorns, and seeds, is laid up during the fall for winter use.

I think that one other species of Tamias—possibly *T. Townsendii*—occurs rarely, but I cannot speak positively on this point. I have no knowledge of the existence of any Flying Squirrels (*Pteromys*) in Arizona.

The genus *Spermophilus*, comprising the true Ground Squirrels, or Squirrel Marmots, is well represented by quite numerous species, though none of them occur in such multitudes as to form the colonies for which some are so noted in other countries.

One of the smallest and the most beautiful of our

Spermophiles is the elegant little *S. Harrisii* of Audubon and Bachman. It is only about as large as a Chipmunk; has stripes which make it look very much like one, and many habits in common with it. The Arizonian species particularly resembles the *Tamias dorsalis* in general appearance, as viewed in life, and frequents precisely the same sort of localities. Though still very rare in collections, it is common enough in Western Arizona, and in fact in the greater part of the desert region about Fort Mojave, on both sides of the Colorado River. I saw a great many at different times in the autumn near Beal's Springs, where I found them in the most rocky and precipitous places. It was difficult to procure specimens, not only from the nature of the region, but on account of their extreme agility, and their unwillingness to venture at any time far from their secure rocky retreats.

The common and notorious California Ground Squirrel (*S. Beecheyi*) ranges eastward across the Colorado valley, though in Arizona it is by no means so abundant as in California, where it forms colonies approaching those of the prairie dog in extent, and is a great pest to the farmer. In the vicinity of Los Angeles, I had an excellent opportunity of studying its habits. On the flat or slightly rolling dry plains which stretch between that town and the sea-beach, it is exceedingly numerous. The burrows occur usually in clusters, and upon little mounds or hillocks of dirt formed by the soil heaped up during their excavation; but single ones are scattered in every direction. Upon these "earth-works" the animals may be seen at all times, sitting upright, and motionless as statues, their fore-paws drooped, and their eyes intently fixed upon the passer-by; or, when no suspicious object appears, lying and basking in the sun, or playing merrily

with each other upon the ramparts of their citadels. I have no doubt that the subterranean passages intercommunicate, and that each animal does not have its own entrance, though he may possess private apartments below. In the vicinity of large encampments, the grass, herbage, and in fact everything green is so closely cropped, that the ground is almost bare; and it becomes a matter for wonder that so many animals can contrive to fill their stomachs. As is the case with those of the prairie dog, the villages are inhabited by a species of burrowing owl, which takes possession of deserted holes. Over the dry plain the graceful mountain plover courses swiftly along; while overhead, or resting upon the ground, is the great squirrel hawk, on the look-out for its prey.

The general manners of these animals call forcibly to mind the prairie dogs. Like them, they hardly venture far from their burrows, to which they hasten precipitately on the first sign of an alarm. Reaching the entrance, they stop a moment in a squat attitude, or rise on their hind-quarters, the better to reconnoitre, venting their displeasure and suspicion by a sharp, chattering bark. They are tough, muscular animals, and must be hard hit to be killed; and even when mortally wounded, will make use of their convulsive death-struggles to reach their burrows, into which they at last drop exhausted, and may be thus lost to the collector.

The Line-tailed Spermophile (*S. grammurus* Say), is another common species, especially of the southern portions, whence it extends into Mexico. It has a peculiar appearance, produced mainly by its tail, calling to mind a true *Sciurus;* so much so, that it has been placed in that genus by some writers, although a true *Spermophilus*.

Observers agree in according to it decidedly arboreal habits. It is both a rock and woods-loving species, and Mr. J. H. Clark, who found it abundant at the copper mines, says it seems to choose its abode mainly with reference to a supply of food, making its burrow indifferently in loose soil, under rocks, or in hollow trees.

The Round-tailed Spermophile (*S. tereticauda* Baird) is a little known species, first described from specimens taken at Fort Yuma, whose precise extent of range remains to be determined. I have not met with it, and believe that no information concerning its habits has been put on record. The chief peculiarity lies in its tail, which is disproportionately long for this genus, cylindrical in shape, and very long-haired. It is among the smaller species, being only about six inches in length of body; is above of a light yellowish-brown, finely grizzled, and below of a soiled yellowish-white.

In addition to the preceding, several Mexican species may very likely extend into the Territory from Sonora. Such are *S. Mexicana*, *S. spilosoma*, and possibly *S. Couchii*. The common little *S. tridecemlineatus*, of the Missouri region, has been found so far south-west as Fort Thorn, N. M., and possibly should also be included. *S. lateralis*, a species closely allied to *S. Harrisii* has been found in the Des Chutes Basin, and may extend as far south as Arizona.

A step further from the true squirrels brings us to the Prairie "Dogs," as they are called; formerly classed with the Spermophiles, to which they are closely allied, but now more properly placed in a distinct genus (*Cynomys*). They mainly differ from the true Spermophiles in the extreme brevity of the tail, the very rudimentary cheek-pouches, and some dental and cranial peculiarities. The

species are strictly terrestrial, and eminently gregarious, being noted for the large colonies which they form. Long as they have been known, and much as has been learned about them, there are many points of their social and individual economy which remain very obscure. Such are those relating to their migrations, their supplies of food and water, their gestation, and their relations with the owls and rattlesnakes found among them. The commonest of our two species, *C. Ludovicianus*, is mainly confined to the great central plains. A second species occurs in Arizona; the short-tailed Prairie Dog (*C. Gunnisonii* Baird), named in 1855 from specimens brought from Coachetope Pass by Capt. Beckwith. It is distinguished from the other by its smaller size, somewhat different colors, and still shorter tail, which is not tipped with black. I was so fortunate as to secure a specimen of this rare animal, near the San Francisco Mountains, in July of 1864. A colony had settled in one of the little open grassy glades which are scattered like oases through that wild and broken region. No owls or rattlesnakes were to be seen, though a species of horned toad (*Phrynosoma Douglassii*) was extremely abundant. Their cries, movements, and general manners were much like those of the common species.

Passing over the marmots proper (*Arctomys*), of which I have no knowledge as Arizonian animals, there only remains to be noticed one more member of the *Sciuridæ*, —the Beaver (*Castor Canadensis* Kuhl). This animal differs in so many essential features, both external and anatomical, as well as in habits, from the family types, that naturalists doubt the propriety of retaining it in its present position. It is found abundantly on all the streams of the Territory. Judging from the accounts of

old trappers, its numbers seem even to have increased of late; owing, doubtless, both to the diminished value of its fur, of which so many articles now take the place, and to the Indian difficulties, which prevent the penetration of the hunter to its abodes. Particularly upon the Rios Salado and San Francisco is it very abundant; and its dams occur, in some places, every few hundred yards. The almost unbroken seclusion of these retreats gives the animals such a sense of security, that they are less strictly nocturnal in working or playing than in most localities. I have frequently seen them swimming about in broad daylight.

An Indian name of this animal, which I do not recall, signifies "little brother," and is given in recognition of that sagacity, or instinct, or reason, as it may be called, which is displayed in its social and domestic economy. But as one writer has well remarked, all that has been said concerning the wonderful intelligence, or even apparent "forethought" of the Beaver, only argues an instinctive knowledge to a degree possessed by a multitude of other animals; and far outrivalled by that required for the construction of many a bird's or insect's nest. Even the humble and despised muskrat builds habitations requiring almost as much constructive dexterity; and, in many of its habits, evinces a "forethought" quite equal to that of the Beaver. The keen pursuit of the Beaver for its money value, and the conspicuousness of some of its works, are the main causes of its unusual notoriety, and of the admiration with which it is always mentioned in trappers' narratives, and naturalists' embellishments of them. — *To be continued.*

THE HOME OF THE BEES.

BY A. S. PACKARD, JR., M. D.

THE history of the Honey-bee, of its wonderful instincts, its elaborate cells and complex economy, have engrossed the attention of the best observers, even from the time of Virgil, who sang of the Ligurian bee. The literature of the art of bee-keeping is already very extensive. Numerous bee journals and manuals of bee-keeping testify to the importance of this branch of agriculture, while able mathematicians have studied the mode of formation of the hexagonal cells,* and physiologists have investigated the intricate, and, as yet, unsolved problems of the generation and development of the bee itself.

In discussing these difficult questions, we must rise from the study of the simple to the complex, remembering that—

> "All nature widens upward. Evermore,
> The simpler essence lower lies:
> More complex is more perfect—owning more
> Discourse, more widely wise,"

and not forget to study the humbler allies of the Honey-bee. We shall, in observing the habits and homes of the wild bees, gain a clearer insight into the mysteries of the hive.

The great family of bees is divided into social and solitary species. The social kinds live in nests composed of numerous cells in which the young brood are reared. These cells vary in form from those which are quite regularly hexagonal, like those of the Hive-bee, to those which are less regularly six-sided, as in the Stingless-bee

*The cells are not perfectly hexagonal. See the studies on the formation of the cells of the bee, by Professor J. Wyman, in the "Proceedings of the American Academy of Arts and Sciences." Boston, 1866.

of the tropics (*Melipona*), until in the Humble-bee the cells are isolated and cylindrical in form.

Before speaking of the wild bees, let us briefly review the life of the Honey-bee. The queen bee having wintered over with many workers, lays her eggs in the spring, first in the worker, and, at a later period, in the drone-cells. Early in the summer the workers construct the large, flask-shaped queen-cells, which are placed on the edge of the comb, and in these the queen larvæ are fed with rich and choice food. The new queens form new swarms. The new-born queen takes her marriage flight high in the air with a drone, and on her return undertakes the management of the hive, and the duty of laying eggs. When the supply of queens is exhausted, the workers destroy the drones. The first brood of workers live about six weeks in summer, and then give way to a new brood. The queens, according to Von Berlepsch, are known to live five years, and, during their whole life, lay more than a million eggs.

In the tropics, the Honey-bee is replaced by the Meliponas and Trigonas. They are minute stingless bees, which store up honey and live in colonies often of immense extent. The cells of Melipona are hexagonal, nearly approaching in regularity those of the Hive-bee, while the honey cells are irregular, being much larger cavities which hold about one-half as much honey as a cell of the Humble-bee. "Gardner, in his travels, states that many species of Melipona build in the hollow trunks of trees, others in banks; some suspend their nests from the branches of trees, whilst one species constructs its nest of clay, it being of large size." (F. Smith.)

In a nest of *Trigona carbonaria*, from eastern Australia, Mr. F. Smith, of the British Museum, found from four

hundred to five hundred dead workers, but no females. The combs were arranged precisely similar to those of the common wasp. The number of honey-pots which were placed at the foot of the nest was two hundred and fifty. Mr. Smith inclines to the opinion that the hive of Trigona contains several prolific females, as the great number of workers can only be thus explained, and M. Guerin found six females in a nest of *Melipona fulvipes*.

At home, our nearest ally of the true Honey-bee, is the Humble-bee (*Bombus*), of which over forty species are known to inhabit North America.

The economy of the Humble-bee is thus: the queen awakens in early spring from her winter's sleep beneath the leaves or moss, or in deserted nests, and selects a nesting place generally in an abandoned nest of a field-mouse, or beneath a stump or sod, and "immediately," according to Mr. F. W. Putnam,* "collects a small amount of pollen mixed with honey, and in this deposits from seven to fourteen eggs, gradually adding to the pollen mass until the first brood is hatched. She does not wait, however, for one brood to be hatched before laying the eggs of another, but, as soon as food enough has been collected, she lays the eggs for a second. The eggs (Plate 10, Fig. 2), are laid, in contact with each other, in one cavity of the mass of pollen, with a part of which they are slightly covered. They are very soon developed; in fact the lines are nowhere distinctly drawn between the egg and the

*Notes on the Habits of the Humble-bee, Proceedings of the Essex Institute, vol. iv, 1864, p. 101. Mr. Angus thus writes us concerning the habits of *B. vagans*. "I have found the males plentiful near our garden fence, with a hole such as would be made by a mouse. They seem to be quite numerous. I was attracted to it by the noise they were making in fanning at the opening. I counted at one time as many as seven thus employed, and the sound could be heard several yards off. Several males were at rest, but mostly on the wing, when they would make a dash among the fanners, and all would scatter and sport around. The workers seem to be of a uniform size, and full as large as the males. I think the object of the fanning was to introduce air into the nest, as is done by the Honey-bees."

larva, the larva and pupa, and again between the latter and the imago; a perfect series, showing this gradual transformation of the young to the imago can be found in almost every nest.

"As soon as the larvæ are capable of motion and commence feeding, they eat the pollen by which they are surrounded, and, gradually separating, push their way in various directions. Eating as they move, and increasing in size quite rapidly, they soon make large cavities in the pollen mass. When they have attained their full size, they spin a silken wall about them, which is strengthened by the old bees covering it with a thin layer of wax, which soon becomes hard and tough, thus forming a cell. (Plate 10, Figs. 1, 2.) The larvæ now gradually attain the pupa stage, and remain inactive until their full development. They then cut their way out, and are ready to assume their duties as workers, small females, males or queens.

"It is apparent that the irregular disposition of the cells is due to their being constructed so peculiarly by the larvæ. After the first brood, composed of workers, has come forth, the queen bee devotes her time principally to her duties at home, the workers supplying the colony with honey and pollen. As the queen continues prolific, more workers are added, and the nest is rapidly enlarged.

"About the middle of summer, eggs are deposited, which produce both small females and males." . . . "All eggs laid after the last of July produce the large females, or queens, and, the males being still in the nest, it is presumed that the queens are impregnated at this time, as, on the approach of cold weather, all except the queens, of which there are several in each nest, die."

While the Humble-bee in some respects shows much less instinct than the solitary bees mentioned below, it stands higher in the series, however, from having workers, as well as males and females, who provide food for the young. The labors of the Mason-bees, and their allies, terminate after the cell is once constructed and filled with pollen. The eggs are then left to hatch, and the young care for themselves, though the adult bee shows greater skill in architecture than the Humble-bee. It is thus throughout nature. Many forms comparatively low in the scale of life astonish us with certain characters or traits, reminding us of beings much superior, physically and intellectually. The lower forms constantly reach up and in some way ally themselves with creatures far more highly organized. Thus the fish-like seal reminds us strikingly of the dog, both in the form of the head, in its docility and great intelligence when tamed, and even in its bark and the movements of the head.

The parasites of the Humble-bee are numerous. Such are the species of *Apathus*, which so closely resemble the Humble-bee itself, that it takes long study to distinguish them readily. Its habits are not known, other than that it is found in the nests of its host. It differs from the Humble-bee in having no pollen-basket, showing that its larvæ must feed on the food stored up by their host, as it does not itself collect it. The mandibles also are not, like those of Bombus, trowel-shaped for architectural purposes, but acutely triangular, and are probably not used in building.

The larvæ of various moths consume the honey and waxen cells; the two-winged flies, *Volucella* and *Conops*, and the larvæ of what is either an Anthomyia or Tachina-like fly, and several species of another genus of flies,

Anthrax, together with several beetles, such as the *Meloe*, *Stylops*, and *Antherophagus* prey upon them.

The power of boring the most symmetrical tunnels in solid wood reaches its perfection in the large Virginian Carpenter-bee (*Xylocopa Virginica*). This bee is as large, and some allied exotic species are often considerably larger than the Humble-bee, but not clothed with such dense hairs. We have received from Mr. James Angus, of West Farms, N. Y., a piece of trellis from a grape-vine, made of pine wood, containing the cells and young in various stages of growth, together with the larvæ and chrysalids of *Anthrax sinuosa*, a species of fly parasitic on the larva, which buries its head in its soft body, and feeds on its juices. (Plate 10, Fig. 5, tunnel containing pollen and young; 6, the larva; 7, the pupa, of *Anthrax sinuosa*.

Mr. Angus thus writes us regarding its habits under date of July 19: "I asked an intelligent and observing carpenter yesterday, if he knew how long it took the Xylocopa to bore her tunnel. He said he thought she bored about one-quarter of an inch a day. I don't think myself she bores more than one-half inch, if she does that. If I mistake not, it takes her about two days to make her own length at the first start; but this being across the grain of the wood may not be so easily done as the remainder, which runs parallel with it. She always follows the grain of the wood, with the exception of the entrance, which is about her own length. The tunnels run from one to one and a half feet in length. They generally run in opposite directions from the opening, and sometimes other galleries are run one above the other, using the same opening. I think they only make new tunnels when old ones are not to be found, and that the same tunnels are

used for many years. Some of the old tunnels are very wide. I have found parts of them about an inch in diameter. I think this is caused by rasping off the sides to procure the necessary material for constructing their cells. The partitions are composed of wood-raspings, and some sticky fluid, probably saliva, to make it adhere.

"The tunnels are sometimes taken possession of by other bees and wasps. I think when this is the case, the Xylocopa prefers making a new cell to cleaning out the mud and rubbish of the other species. I frequently find these bees remaining for a long time on the wing close to the opening, and bobbing their heads against the side, as if fanning air into the opening. I have seen them thus employed for twenty minutes. Whether one bee or more makes the tunnel, that is, whether they take turns in boring, I cannot say at present. In opening the cells, more than one are generally found, even at this season. About two weeks ago, I found as many as seven, I think, in one."*

The hole is divided by partitions into cells about seven-tenths of an inch long. These partitions are constructed of the coarse dust or chippings made by the bee

*"Since writing the above I have opened one of the new holes of Xylocopa which was commenced between three and four weeks ago, in a pine slat used in the staging of the greenhouse. The dimensions were as follows: Opening fully 3-8 wide; depth 7-16; whole length of tunnel 6 5-16 inches. The tunnel branched both ways from the hole. One end, from opening, was 2 5-8, containing three cells, two with larva and pollen, the third empty. The other side of the opening, or the rest of the tunnel, was empty, with the exception of the old bee (only one) at work. I think this was the work of one bee, and, as near as I can judge, about twenty-five days' work. Width of tunnel inside at widest 9-16 inch.

For some days this bee has been discharging a great quantity of saw-dust and pollen, which I had collected by placing a vessel under it. It would seem that she had cells constructed also in the opposite side of the hole, and that she removed them to enlarge the tunnel. Among the stuff thrown out, I find a partition of a cell nearly entire. I will enclose you the stuff thus collected, and also some of the first castings.

I have just found a Xylocopa bobbing at one of the holes, and in order to ascertain the depth of the tunnel, and to see whether there were any others in them, I sounded with a pliable rod, and found others in one side, at a depth of five and one half inches; the other side was four inches deep, without bees. The morning was cool, so that the object in bobbing could not be to introduce fresh currents of air, but must have had some relation to those inside. Their legs on such occasions are, as I have noticed, loaded with pollen."

in eating out her cells, for our active little carpenter is provided with strong cutting jaws, moved by powerful muscles, and on her legs are stiff brushes of hair for cleaning out the tunnel as she descends into the heart of the solid wood. She must throw out the chips she bites off from the sides of the burrow with her hind legs, passing the load of chips backwards out of the cell with her fore-limbs, which she uses as hands.

The partitions are built most elaborately of a single flattened band of chips, which is rolled up into a coil four layers deep. One side, forming the bottom of the cell, is concave, being beaten down and smoothed off by the bee. The other side of the partition, forming the top of the cell, is flat and rough.

At the time of opening the burrow, July 8th, the cells contained nearly full-grown larvæ, with some half developed. They were feeding on the masses of pollen, which were large as a thick kidney-bean, and occupied nearly half the cell. The larvæ (Plate 10, Fig. 4) resemble those of the Humble-bee, but are slenderer, tapering more rapidly towards each end of the body.

The habits and structure of the little green *Ceratina* ally it closely with Xylocopa. This pretty bee, named by Say *Ceratina dupla*, tunnels out the stems of the elder or blackberry, syringa, or any other pithy shrub, excavating them often to a depth of six or seven inches, and even, according to Mr. Haldeman (Harris MS.), bores in acorns. She makes the walls just wide enough to admit her body, and of a depth capable of holding three or four, often five or six cells (Plate 10, Fig. 11). The finely built cells, with their delicate silken walls, are cylindrical and nearly square at each end, though the free end of the last cell is rounded off. They are four and a

half tenths of an inch long, and a little over one-third as broad. The bee places them at nearly equal distances apart, the slight interval between them being filled in with dirt.

Dr. T. W. Harris* states that, May 15, 1832, one female laid its eggs in the hollow of an aster-stalk. Three perfect insects were disclosed from it July 28th. The observations of Mr. Angus, who saw some bees making their cells, May 18th, also confirms this account. The history of our little upholsterer is thus cleared up. Late in the spring she builds her cells, fills them with pollen, and lays one or more eggs upon each one. Thus in about two months the insect completes its transformations; within this period passing through the egg, the larval and chrysalid states, and then, as a bee, living a few days more, if a male; or if a female, living through the winter. Her life thus spans one year.

The larva (Plate 10, Fig. 10) is longer than that of Megachile, and compared with that of Xylocopa, the different segments are much more convex, giving a serrate outline to the back of the worm. The pupa, or chrysalis, we have found in the cells the last of July. It is white, and three-tenths of an inch long. It differs from that of the Leaf-cutter bee in having four spines on the end of the body.

In none of the wild bees are the cells constructed with more nicety than those of our little Ceratina. She bores out with her jaws a long deep well just the size of her body, and then stretches a thin delicate cloth of silk drawn tight as a drum-head across each end of her chambers, which she then fills with a mixture of pollen and honey.

* According to a note in MSS. deposited in the Library of the Boston Society of Natural History.

Her young are not, in this supposed retreat, entirely free from danger. The most invidious foes enter in and attack her young. Three species of Ichneumon-flies, two of which belong to the Chalcid family, lay their eggs within the body of the larva, and emerge from the dried larva and pupa skins of the bee, often in great numbers. The smallest parasite, belonging to the genus *Anthophorabia*, so called from being first known as a parasite on another bee, *Anthophora*, is a minute species found also abundantly in the tight cells of the Leaf-cutter bee.

The interesting habits of the Leaf-cutting, or Tailor-bee (*Megachile*), have always attracted attention. This bee is a stout, thick-bodied insect, with a large square head, stout, sharp, scissors-like jaws, and with a thick mass of stout dense hairs on the under-side of the tail for carrying pollen, as she is not provided with the pollen-basket of the Honey and Humble-bee.

The Megachile lays its eggs in burrows in the stems of the elder (Plate 10, Fig. 9), which we have received from Mr. James Angus; we have also found them in the hollows of the locust tree. Mr. F. W. Putnam thus speaks of the economy of *M. centuncularis*, our most common species. "My attention was first called, on the 26th of June, to a female busily engaged in bringing pieces of leaf to her cells, which she was building under a board, on the roof of the piazza, directly under my window. Nearly the whole morning was occupied by the bee in bringing pieces of leaf from a rose-bush growing about ten yards from her cells, returning at intervals of a half minute to a minute with the pieces which she carried in such a manner as not to impede her walking when she alighted near her hole." We give a figure of the Leaf-cutter bee in the act of cutting out a circular piece of a rose-leaf (Plate 10, Fig. 8).

She alights upon the leaf, and in a few seconds swiftly runs her scissors-like jaws around through the leaf, bearing off the piece in her hind legs. "About noon she had probably completed the cell, upon which she had been engaged, as, during the afternoon, she was occupied in bringing pollen, preparatory to laying her single egg in the cell. For about twenty days the bee continued at work, building new cells and supplying them with pollen. . . . On the 28th of July, upon removing the board, it was found that the bee had made thirty cells, arranged in nine rows of unequal length, some being slightly curved to adapt them to the space under the board. The longest row contained six cells, and was two and three-quarters inches in length; the whole leaf structure being equal to a length of fifteen inches. Upon making an estimate of the pieces of leaf in this structure, it was ascertained that there must have been at least a thousand pieces used. In addition to the labor of making the cells, this bee, unassisted in all her duties, had to collect the requisite amount of pollen (and honey?) for each cell, and lay her eggs therein, when completed. Upon carefully cutting out a portion of one of the cells, a full-grown larva was seen engaged in spinning a slight silken cocoon about the walls of its prison, which were quite hard and smooth on the inside, probably owing to the movements of the larva, and the consequent pressing of the sticky particles to the walls. In a short time the opening made was closed over by a very thin silken web. The cells, measured on the inside of the hard walls, were .35 of an inch in length, and .15 in diameter. The natural attitude of the larva is somewhat curved in its cell, but if straightened, it just equals the inside length of the cell. On the 31st of July, two female bees came out, having cut their way through the

sides of their cells." In three other cells "several hundred minute Ichneumons (*Anthophorabia megachilis*) were seen, which came forth as soon as the cells were opened."

The habits of the little blue or green Mason-bees (*Osmia*), are quite varied. They construct their cells in the stems of plants and in rotten posts and trees, or, like Andrena, they burrow in sunny banks. An European species selects snail shells for its nest, wherein it builds its earthen cells, while other species nidificate under stones. Curtis found two hundred and thirty cocoons of a British species (*Osmia paretina*), placed on the under side of a flat stone, of which one-third were empty. Of the remainder, the most appeared between March and June, males appearing first; thirty-five more bees were developed the following spring. Thus there were three successive broods, for three succeeding years, so that these bees lived three years before arriving at maturity. This may account for the *insect years*, which are like the "apple years," seasons when bees and wasps, as well as other insects, abound in unusual numbers.

Mr. G. R. Waterhouse, in the Transactions of the Entomological Society of London, for 1864 (3d series, vol. 2, p. 121), states that the cells of *Osmia leucomelana* "are formed of mud, and each cell is built separately. The female bee, having deposited a small pellet of mud in a sheltered spot between some tufts of grass, immediately commences to excavate a small cavity in its upper surface, scraping the mud away from the centre towards the margin by means of her jaws. A small shallow mud-cup is thus produced. It is rough and uneven on the outer surface, but beautifully smooth on the inner. On witnessing thus much of the work performed, I was struck

with three points. 1st, the rapidity with which the insect worked; secondly, the tenacity with which she kept her original position whilst excavating; and thirdly, her constantly going over work which had apparently been completed. . . . The lid is excavated and rendered concave on its outer or upper surface, and is convex and rough on its inner surface; and, in fact, is a simple repetition of the first-formed portion of the cell, a part of a hollow sphere."

The largest species of Osmia known to us is a very dark-blue species.* We are indebted to a lady for specimens of the bees with their cells, which had been excavated in the interior of a maple tree several inches from the bark. The bee had industriously tunnelled out this elaborate burrow (Plate 10, Fig. 12), and, in this respect, resembled the habits of the Carpenter-bee (*Xylocopa*), more closely than any other species of its genus.

The tunnel was over three inches long, and about three-tenths of an inch wide. It contracted a little in width between the cell, showing that the bee worked intelligently, and wasted no more of her energies than was absolutely necessary. The burrow contained five cells, each half an inch long, being rather short and broad, with the hinder end rounded, while the opposite end, next to the one adjoining, is cut off squarely. The cell is somewhat jug-shaped, owing to a slight constriction just behind the mouth. The material of which the cell is composed is stout, silken, parchment-like, and very smooth within. The interstices between the cells are filled in with rather coarse chippings made by the bee.

*This seems to be an undescribed species. We will call it the wood-boring Osmia (*Osmia lignivora*). It is larger than the *Osmia lignaria* of Say, being just half an inch long. The head is much shorter, and less square than in Say's species. The front of the head below the antennæ is clothed with dark hairs, but above and on the thorax with yellowish ochreous hairs. The body is deep blackish-blue, with greenish reflections.

The bee cut its way out of the cells in March, and lived for a month afterwards on a diet of honey and water. It eagerly lapped up the drops of water supplied by its keeper, to whom it soon grew accustomed, and seemed to recognize.

Our smallest and most abundant species is the little green *Osmia simillima* of Smith. It builds its little oval, somewhat urn-shaped cells against the roof of the large deserted galls of the oak-gall fly (*Diplolepis confluentus*), placing them, in this instance eleven in number, in two irregular rows, from which the mature bees issue through a hole in the gall (Plate 10, Fig. 14. From specimens communicated by Mr. F. G. Sanborn). The earthen cells, containing the tough dense cocoons, were arranged irregularly so as to fit the concave vault of the larger gall, which was about two inches in diameter. On emerging from the cell the Osmia cuts out with its powerful jaws an ovate lid, nearly as large as one side of the cell.

In the Harris collection are the cells and specimens of *Osmia pacifica* Say, the peaceful Osmia, which, according to the manuscript notes of Dr. Harris, is found in the perfect state in earthen cells beneath stones. The cell is oval cylindrical, a little contracted as usual with those of all the species of the genus, thus forming an urn-shaped cell. It is half an inch long, and nearly three-tenths of an inch wide, while the cocoon, which is rather thin, is three-tenths of an inch long. We are not acquainted with the habits of the larva and pupa in this country, but Mr. F. Smith states that the larva of the English species hatches in eight days after the eggs are laid, feeds ten to twelve days, when it becomes full-grown, then spins a thin silken covering, and remains in an inactive state

until the following spring, when it completes its transformations.

In the economy of our wild bees we see the manifestation of a wonderful instinct, as well as the exhibition of a *limited reason*. We can scarcely deny to animals a kind of reason which differs *only in degree* from that of man. Each species works in a sphere limited by physical laws, but within that sphere it is a free agent. They have enough of instinct and reason to direct their lives, and to enable them to act their part in carrying out the plan of creation. — *To be continued.*

EXPLANATION OF PLATE 10.

Fig. 1. A cell of the Humble-bee; natural size, with the pollen mass built upon the top.

Fig. 2. End view of the same cell, showing the three eggs laid in three divisions of the cavity.

Fig. 3. *Xylocopa Virginica*, the Carpenter Bee.

Fig. 4. The larva of *Xylocopa Virginica*, the Carpenter Bee; natural size.

Fig. 5. The nest containing the cells of the same, with the partitions and pollen masses, on which the young larva is seen in the act of feeding; natural size.

Fig. 6. Young larva of *Anthrax sinuosa*; side view.

Fig. 7. Pupa of *Anthrax sinuosa;* side view; natural size.

Fig. 8. The Leaf-cutter Bee (*Megachile*), on a rose-leaf, in the act of cutting out a circular piece.

Fig. 9. Cells of Megachile, in the elder; natural size.

Fig. 10. Larva of *Ceratina dupla*, the little green upholsterer Bee; enlarged.

Fig. 11. Cells of the same in the stem of the elder; natural size.

Fig. 12. Cells of *Osmia lignivora*, new species, the wood-devouring Mason-bee, excavated in the maple; natural size.

Fig. 13. Cells of *Osmia simillima*, the common green Mason-bee, built in the deserted gall of the Oak-gall Fly.

Fig. 14. A single earthen cell of the same; natural size.

Fig. 15. Pollen mass, or bee-bread of *Osmia lignaria;* natural size. It is made up of distinct pellets of pollen, which are probably stuck together with saliva.

PACKARD'S HOME OF THE BEES.

THE CHIGNON FUNGUS.

BY TILBURY FOX, M. D.

NOTHING could more clearly have shown the amount of ignorance of the natural history of minute life abroad amongst the public, and the little trouble people will take to make the most trivial use of their common sense, when a novelty, embellished by plausible description, is presented to them, than the rampant nonsense which has been penned and believed in regard to the so-called gregarinæ infesting certain varieties of false hair. The "chignon controversy" has been one of the most widespread, but at the same time transient sensations of the age: started abroad, it soon reached England, where it bewildered the fashion worshippers of the day. The immediate cause of this hubbub was the appearance in the Hamburg paper *Der Freischütz*, of the 7th of February, 1867, of an article based upon the account given in the "Archiv der Gerichtlich Medicin und Hygiene," and in which we are informed that "Mr. Lindemann professes to have discovered and observed a new microscopical parasite, to which he has given the name of Gregarine. He reports, according to his observations, that the gregarine —a protozoic animalcule—is of the lowest order of development of the animal organism, and is found parasitically within the animal and human body, where it floats about with the blood, by which it is nourished. The most striking instance of the parasitism of the gregarine is said to be its existence on the human hair. The gregarinous hair, however, differs in no way from the sound hair. Only if one looks very closely, little dark brown knots, which are generally at the free end of the hair,

may be distinguished even with the naked eye. These are gregarines. Out of thirty samples of hair procured from a hairdresser in Nishni Novgorod, gregarines were found in seventy-five per cent. And it is well known that the hair used for the chignons of the better half of Russia is bought of the poor peasant women, who are proverbially of dirty habits. Pursuing his inquiry, Mr. Lindemann has discovered that almost every louse has in its interior an enormous number of gregarines, and he convinced himself by further experiments that the gregarines on the human hair are deposited there by lice. He observes that the most favorable conditions for the growth of gregarinæ are light, increased temperature, and a moist atmosphere; and he declares that in the ballroom these are not without their influence on the parasites when they exist on false hair, for they at once revive, grow, and multiply, get disseminated in millions, and in consequence of the increased respiration produced by the exertion of dancing, are inhaled freely into the lungs, reach their specific gregarine nature, and after a while induce disease in the body."

In these quotations prevalent fashions were depicted as sources of danger, inducing discomfort and disease. A writer in one of the daily papers ("Investigator") asserted that he had witnessed from direct observation the development of gregarine into lice, an assumption that implies a liberty with Darwinism that its most zealous and radical devotees would at the present time hesitate to suggest. It is only just to say that the *Lancet*, which first noticed the matter, and confined itself to a mere mention of the facts, urged its readers to accept the statements put forth, with the gravest caution. Lindemann's assertions are very startling to scientific men, because

they are wholly in antagonism with observed facts. Whilst scientific research has as yet afforded little insight of the habits of the lower forms of animal and vegetable life, the revelations of the microscope within the last few years are pregnant with significance as regards their ubiquity, and teach us that we are not to be astonished if we find living forms in unexpected sites, undergoing the most manifold variations in aspect when brought under the play of different influences. At the same time we have the amplest experience to caution us against the acceptance of new species without the keenest criticism. What, then, is the truth in this matter? In my devotion to the subject of diseases of the skin, it has lain in my way during the last ten years to investigate the whole subject of diseases of the hair connected with the development of vegetable parasites, and I think no one has made a larger number of microscopic observations. I have never seen a true gregarina in connection with the hair; but I have recently found a vegetable growth on false German hair answering in naked eye appearances to that described by Lindemann as little dark specks surrounding the hair towards its end. Gregarinæ, according to Lindemann, are made up of cells, which he states to be vegetable, and it is possible that that which I have found may be identical with his gregarinæ. I cannot help thinking that many bodies totally dissimilar in nature have been classed with gregarinæ, which my friend Ray Lankester, than whom no higher authority on the point exists, declares to be truly animal. The growth I have found I now proceed to describe.

If you take a hair on which the parasite exists, and hold it between yourself and the light, towards the outer half you will see one or more, perhaps half a dozen, little dark

knots the size of pin-points, surrounding the shaft of the hair; they are readily felt on drawing the hair through the fingers; they are somewhat difficult to detach. If a hair be placed under the microscope with a quarter-inch objective, the mass will be seen to be made up of cellular bodies surrounding the hair, such as are seen in Fig. 1, kindly drawn for me by Dr. Braxton Hicks, F. R. S.

Fig. 1.

It will be seen that the mass has the appearance of a fungus growth, of which two distinct forms are here present, viz., *mycelial* or *filamentous*, seen in the central part of Fig. 1; and *sporular* or *cellular*, seen in Fig. 2, which is the outer part of Fig. 1.

The hair is apparently healthy, and if the slide be pressed the mass will break away from the hair on either side, bringing away with it more or less of the cuticle, and leaving behind a healthy shaft. The cells are seen to be of various shapes and sizes. Fig. 3 gives a good representation of them; they are from $\frac{1}{4000}$ to $\frac{1}{3000}$ inch; many are like the torula cells developed from Penicillium. Others are larger, undergoing division very actively; they may be subdivided into two, three, or four parts, or much more freely. This indicates the assumption by the parasite of an algal condition. In watching the mass on the hair carefully, it is evident that

Fig. 2.

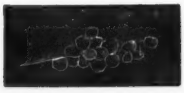


Fig. 3.

a number of cells become detached from the outer or sporular form, and at once move actively about. These small cells indicate an active growth by subdivision, and a fruitful source of propagation; they subsequently become the cells seen in Fig. 3. Certainly this variety of fungus so far described is the most active growth I have come across in my researches, and I have been enabled to germinate it most successfully, so as to set all questions as to its nature completely at rest. Placed under favorable circumstances in water, the spores (Fig. 3) enlarge considerably, and the mycelial filaments increase also; but there is at this time to be observed a very remarkable occurrence, though not in all cases. Some of the large cells in Fig. 1, have become filled with smaller cells; and in others, in addition to these, processes have been put forth from the circumference of the walls in a radiating manner; in other cases the enlarged cells have two long cilia attached to them, by which they move about rapidly, whilst a part of the hair, previous to this free from the fungus, has become dotted all over by minute cells similar to those seen in the interior of the larger ones. All this is seen in Fig. 4.

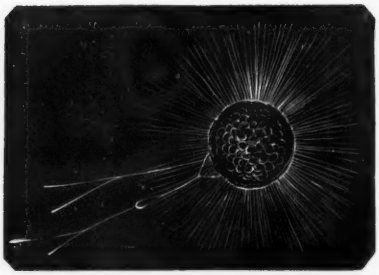
Fig. 4.

But more than this, I have observed most distinctly large cells filled with smaller cells, furnished with exceedingly delicate radiating processes and putting forth pseudopodia. One of these cells of large size is represented in Fig. 5.

It will here be seen to have assumed the features of an amæboid body. Nothing could have been more distinct to myself, and those who were observing with me, than

this peculiar form; and it seems to me that we have here a pretty complete history of the life of this fungus,—namely, the sporular subdividing and assuming an algal form, which in turn becomes amœbiform, and furnishes ciliated cells that supply the earliest condition of the fungus, as seen in Fig. 4, scattered over the hair.

Fig. 5.



But not satisfied with these results, I set to work to grow the fungus in sugar and water, under constant observation. A rapid enlargement of the sporular cells took place, as in the former case, and in some of the larger cells the most distinct circulation of the granules around the inner circumference of the parent cell was witnessed by myself and my friends, and a beautiful object it was. Finally, I obtained a result similar to the former one.

Fig. 6 represents the appearance of the fungus at the end of fourteen days, seen with an ½ inch object-glass.

Fig. 7 is a portion of the mycelium, taken from the part over the hair, more highly magnified with a 1-12th object-glass.

The ends of the filaments seen in Fig. 8 are analogous, in fact identical with those forms which I have figured in my work on *parasitic diseases of the skin* as resulting from the growth of *oidium*. The globose head contains spores, and is an early stage. The double cell figured in the centre was of a green color like many others.

Accompanying these appearances were, as in the former case, cells—filled with smaller cells and granules in ac-

Fig. 6.

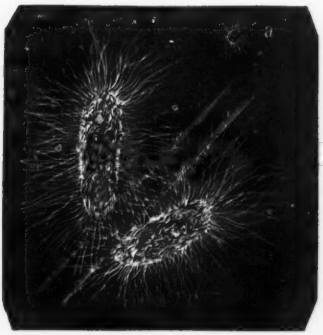


Fig. 7.

tive motion—furnished with cilia, and bodies undergoing the "amœboid" transformation, as seen in Figs. 9 and 10, with 1-12 inch Powell and Lealand.

Here, again, we have the growth taking on an algal

Fig. 8.

Fig. 9.

Fig. 10.

phase in one direction, and fructifying into a perfect fungus on the other hand. The drawings I have given were made on the spot from the microscopic objects, and I

must do the artist credit to say he has most faithfully and cleverly portrayed the actual appearances presented by the parasite. The observations now recorded are in complete harmony with those of Dr. Braxton Hicks on the Volvox, and De Bary in his work published in 1864, at Leipsic, "Die Mycetozoen, Ein Beitrag zur Kentniss Der Neidersten Organismen," and are completely confirmatory of the opinion before advanced by myself, that the fungi found upon or within man belong to one genus, and undergo an infinity of variations under different circumstances. In the present case the fungus approaches to the character of Torula rather than any other. There are many most interesting questions that cannot be discussed here. The only one I need refer to is the influence which this species of parasite has in the production of disease. In the immediate condition in which we find it on the hair it need cause but little anxiety; but the minute form as seen in Fig. 4, transplanted to a suitable soil—and the scalp of delicate children best furnishes it—would produce disease of the scalp: of that I have no doubt. Luckily, the tissues of adults, namely, those who wear chignons, are not prone to the more severe forms of diseases produced by vegetable parasites; and as the mass of false hair used in England is free from the fungus described above, the total danger, on the whole, is slight. —*Hardwicke's Science-Gossip.*

NOTE.—*Torula*, *Penicillium*, and *Oidium* are microscopic genera of fungi. The word algal is derived from *alga*, a sea-weed, of which there are many minute species. *Pseudopodia* is derived from the Greek, meaning "false-feet;" they are the organs of locomotion, being mere extensions of the side, or walls of the body of Infusoria. In Fig. 5 they radiate like hairs from the body of the plant. *Amœba* is a low Infusorium, or Rhizopod.

REVIEWS.

AN ELEMENTARY TREATISE ON AMERICAN GRAPE CULTURE AND WINE MAKING. By *Peter B. Mead.* Illustrated with nearly two hundred engravings, drawn from nature. New York, 1867. Harper & Brothers. 8vo.

This is a carefully prepared work, and we are informed by those who are specially interested in Grape Culture that it contains much valuable information. Mr. Meade has certainly shown that he was well prepared for the task before him. Besides the several chapters on Climate, Location, Soil, Manures, Laying out and Planting a Vineyard, Training on the various Systems, Planting and Propagation, etc., etc., there is a full chapter devoted to the Diseases and Insects to which the Vine is subject, with figures of the various species of insects. The article on "Mildew" treats of some of the causes and the prevention of this destructive fungus-disease in a comprehensive manner. The chapter on Wine-making also contains much of scientific interest, with an account of Pasteur's experiments, by which he shows that "souring," "acetification," "mould," etc., are each produced by a different vegetable parasite or fungus, which, if allowed to go on to mature growth, will spoil the wine, but which is prevented by heating. This heating does not injure the wine, but actually, according to M. Pasteur, has the effect of hastening its ripening, and bringing forth in a few hours those fine qualities that have heretofore only been secured by long and careful keeping in good cellars.

ANNUAL REPORT OF THE TRUSTEES OF THE MUSEUM OF COMPARATIVE ZOÖLOGY, CAMBRIDGE, TOGETHER WITH THE REPORT OF THE DIRECTOR, 1866. Boston, 1867. 8vo, pp. 37.

This Report of the Cambridge Museum is mainly taken up with an account of the Thayer Expedition to Brazil, under the charge of Professor Agassiz. The additions from this source consisted largely of fishes and reptiles. "Of fishes alone, no less than 50,000 specimens were actually counted, representing over 2,200 species, the majority of which, say 2,000, are probably new to science and to our collections. This estimate does not include the smaller specimens, less than two inches in length, which also number many thousands." The reports of the assistants, Messrs. A. Agassiz, P. R. Uhler, J. G. Anthony, and N. S. Shaler, show that good progress had been made in their departments.

A second number of the Illustrated Catalogue, The North American

Acalephæ, by Mr. Alexander Agassiz, has been printed and distributed. The third number will contain Professor Agassiz's Report on the Coral Reefs of Florida, originally prepared for the use of the Coast Survey, the latter part of which will be finished by Mr. Theodore Lyman.

Collections of several classes of animals have been sent to naturalists, abroad and at home, for study and identification, many of which were sent from the Brazilian Expedition, though unfortunately lost.

The practice of scattering among naturalists the material for study, a system now pursued by nearly all museums, public and private, illustrates the mutual dependence of museums, and those engaged in the study of science. The benefits are not local, but are shared by all, and not in one country alone, but throughout the scientific world. Thus, a large museum carried on in the interests of the highest education, must do much towards uniting all men in interpreting the marvels of creation.

Already in this country the value of maintaining large museums is widely felt. We cannot afford to stint any of our educational institutions. We cannot have too many scientific schools, or too many museums, and money applied to their endowment will surely tend to enrich the nation, as well as advance good learning and the broadest culture.

THE AMERICAN BEE JOURNAL AND GAZETTE. Edited and published monthly, by *Samuel Wagner*, Washington, D. C. 8vo, $2 a year.

With the July number this important journal begins a new volume, and in an improved dress. It has been steadily gaining in interest and permanent value. No bee-keeper, or student of insects, can do without this work. We hope the circulation will be largely increased, and that the growing interest in so remunerative a branch of agriculture as bee-keeping will enable it to be a success.

NATURAL HISTORY MISCELLANY.

BOTANY.

A SUPPOSED NEW COLUMBINE, AND A NEW OX-EYE DAISY. — On the 15th of May, 1866, I found on the heights west of the Hudson, and opposite the city of Poughkeepsie, N. Y., a cluster of wild Columbine (*Aquilegia*), with all the flowers of a delicate yellow color. I preserved a specimen for my herbarium, and sent a specimen, still fresh, to Professor Gray, of Harvard College. He wrote me that he had seen an approximation to this variety, "but never before one in which the

red or purple was wholly absent." On the 17th of May this year, 1867, I found the same variety again, near the same place where I found it last year. Is it probable that it is a well-marked variety, or perhaps a new species? I shall try to raise it from the seed, and the readers of the NATURALIST shall in due time be notified of the result. Meanwhile I call it the yellow-flowered Columbine (*Aquilegia flaviflora*).

On the 8th of June, 1867, several specimens of a new form of Ox-eye Daisy (*Leucanthemum*) were gathered in the fields of Hon. Matthew Vassar, of Poughkeepsie, N. Y., two of which were kindly sent to me. At first I thought that the plant could be nothing more than a curious form of *Leucanthemum vulgare* Lam., that it was nothing more than the result of a mere freak of nature; and when, on the 10th inst., I went in search of more specimens, I half expected to find the new form and the common one growing on one and the same stem. But although I found specimens by scores, not a stem among them all had the two forms upon it. Nor do the two forms in any observed case—and I have observed many—come from the same root, although the roots of this and the common form grow promiscuously together, and often so near as to touch each other.

The two prominent characters which distinguish this daisy from *L. vulgare*, are the following, namely: *its ray flowers are all tubular, unequally 4–5-lobed*, in some cases only 3-lobed, and *the receptacle*—so far as observed—*very convex;* the stem is also more constantly naked above than in the common one. Having sought in vain for any mention of this form in botanical works, and believing it to be new to science, I have ventured to name it *Leucanthemum tubuliflorum*, or the Tubular-flowered Leucanthemum.

Yesterday, June 13th, I revisited the locality of this flower, and brought home specimens enough for all of my class in botany,—over a hundred in number. I would only add, that I have received a letter from Professor Gray, to whom I sent specimens of the daisy, in which he informs me that while he does not regard it as a new species, he will introduce it into his Manual of Botany as a variety, adopting the name I have given it.—SANBORN TENNEY.

CHANGE OF COLOR IN FLOWERS PLACED UNDER GLASSES OF DIFFERENT COLORS.—M. De Candolle suggested the construction of experimental green-houses and hot-houses, and gave his views as to the plan to be adopted in their erection, so as best to serve the purpose of the physiologist. "A building, such as I propose, would allow of light being passed through colored glasses or colored solutions, and so prove the effect of the different visible and invisible rays which enter into the composition of sunlight. M. Von Martin placed some plants of *Amaranthus tricolor* for two months under glasses of various colors. Under the yellow glass the varied tint of the leaves was preserved. The red glass impeded the development of the leaves, and produced, at the base of the limb, yellow instead of green; in the middle of the upper surface, yellow instead of reddish brown; and below, a red spot instead of purplish red. With the blue glasses, which allowed some green and yellow to pass, that which was red or yellow in the leaf had spread so that there remained only a green border or edge. Under the nearly pure violet glasses, the foliage became almost uniformly green. Now that plants with colored foliage are becoming fashionable, it may interest horticulturists to know that by means of colored glasses, provided they are not yellow, they may hope to obtain, at least, temporary effects as to the coloring of variegated foliage. Nothing would be easier than to create in the experimental hot-house an atmosphere of carbonic acid gas, such as is supposed to have existed in the coal period. Then it might be seen to what extent our present vegetation would take an excess of carbon from the air, and if its general existence were inconvenienced by it. Then might be ascertained what tribes of plants could bear this condition, and what other families could not have existed, supposing the air had formerly had a very large proportion of carbonic acid gas."—*Quarterly Journal of Science, London.*

ZOÖLOGY.

THE STUFFED WHALE IN THE SWEDISH MUSEUM.—Professor Lilljeborg describes, in a letter to Dr. J. E. Gray, how this species of whale (*Balæoptera*) was stuffed, which we translate as follows. The skin of the same was divided into several portions, and then stretched over a model made of wood of the exact form and size of the animal itself. The epidermis is preserved on the skin, and it is still but slightly torn. The layer of blubber is without doubt very thin, otherwise the skin (*epidermis*) would have been filled with rents and wrinkles, which, however, are not to be seen.—*Annals and Magazine of Natural History.*

THE EGGS OF THE DRAGON-FLY.—Since printing the article on the Dragon-fly in our last number we have had an opportunity of seeing the eggs collected by a friend at Haverhill, July 3d, at the first field-meeting of the Essex Institute. The eggs are laid in immense numbers in long ropy, gelatinous masses, nearly one-half an inch thick, attached to an aquatic grass. When folded together, the entire mass was nearly the size of a hen's egg.

The new-born larvæ looked like small spiders swimming in the water, as the abdomen is very short, and the legs remarkably long, the hindermost pair being one-half longer than the body. The body is very transparent, and through the thin wall can be seen the blood coursing rapidly through the dorsal vessel or heart, and returning along the side of the body, as also the smaller currents thrown into and returning from the legs. The little creatures are very active, swimming by hundreds through the water, or crawling over the mass of eggs.

We shall speak at another time of the changes the embryo undergoes before hatching. The eggs are only two and one-half hundredths of an inch long. It is probable that they are the young of Diplax, as they bear a close resemblance to the pupa (fig. 4) figured in our last number.

RAPID CHANGE OF COLOR IN FISH.—I caught the other day in fishing for shells, a small "horned-pout," about two inches long, intensely black in color. I put him in a white bowl to examine him. In half an hour he had turned white, so clear and pretty in color, that you could see the circulation under the skin of the body. Only his "feelers" and eyes remained black, and he is now, three days after capture, lively, healthy, and well bleached. Do these fish usually change their color in this way?—E. C. BOLLES, *Portland, Me.*

NATURAL HISTORY CALENDAR.

INSECTS IN SEPTEMBER.—Few new insects make their first appearance for the season during this month. Most of the species which abound in the early part of the month are the August forms, which live until they are killed by the frosts late in the month. From this cause there is towards the end of the month a very sensible diminution of the number of insects.

The early frosts warn these delicate creatures of approaching cold. Hence the whole insect population is busied late in the month in looking out snug winter quarters, or providing for the continuance of the

species. Warned by the cool and frosty nights, multitudes of caterpillars prepare to spin their dense silken cocoons, which guard them against frost and cold. Such are the "Spinners," as the Germans call them, the Silk-moths, of which the American Silk-worm is a fair example. The last of September it spins its dense cocoon, in which it hybernates in the chrysalis state.

The larvæ of those moths, such as the Sphinges, or Hawk-moths, which spin no cocoon, descend deep into the earth, where they lay in rude earthen cocoons.

The wild bees may now be found frequenting flowers in considerable numbers. Both sexes of the Humble-bee, the Leaf-cutter Bee, and other smaller genera abound during the warm days.

One's attention during an unusually warm and pleasant day in this month is attracted by the clouds of insects filling the air, especially towards sunset, when the slanting rays of the sun shine through the winged hosts. On careful observation these insects will prove to be nearly all ants, and, perhaps, to belong to a single species. Looking about on the ground, an unusual activity will be noticed in the ant-hills. This is the swarming of the ants. The autumnal brood of females has appeared, and this is their marriage day.

The history of a *formicarium*, or ant's nest, is as follows: The workers, only, hybernate, and are found early in spring, taking care of the eggs and larvæ produced by the autumnal brood of females. In the course of the summer these eggs and larvæ arrive at maturity, and swarm on a hot sultry day, usually early in September. The females, after their marriage flight, for the small diminutive males seek their company at this time, descend and enter the ground to lay their eggs for new colonies, or, as Westwood states, they are often seized by the workers and retained in the old colonies. Having no more inclination to fly, they pluck off their wings and may be seen running about wingless.

The autumnal brood of Plant-lice now occur in great numbers on various plants. The last brood, however, does not consist exclusively of males and females, for of some of the wingless individuals previously supposed to be perfect insects of both sexes, Dr. W. I. Burnett found that many were in reality of the ordinary gemmiparous form, such as those composing the early summer broods.

The White Pine Plant-lice, *Lachnus strobi*, may be seen laying their long string of black oval eggs on the needles of the pine. They are accompanied by hosts of two-winged flies, Ichneumons, and in the night by many moths which feed on the Aphis-honey they secrete, and which drops upon the leaves beneath.—A. S. P.